

SCIENCE.

FRIDAY, MAY 15, 1885.

COMMENT AND CRITICISM.

IT MAY NOT BE AMISS to remind a correspondent in to-day's issue that the arguments which he uses to show the peculiar fitness of Col. Coleman for the position of commissioner of agriculture, would, with very slight changes, show him to be qualified to act as director of the geological survey, or superintendent of the census, or, in fact, for any executive position. The work of the department of agriculture is largely scientific work; and, as we had occasion to point out in the remarks to which our correspondent takes exception, the proper and effective direction of such work requires something more than ordinary executive and business ability. "The ability to distinguish and recommend what is best, to discover and make use of the ability of specialists," implies a thorough knowledge of what has already been done, and of the distinguishing qualities of the 'best,' an acquaintance with specialists, and a capability of judging of the merit of their work, such as only a 'technical expert' can possess. A man who, without special scientific attainments, undertakes to direct the work of scientific specialists, must inevitably stand much in the same position as the typical fine lady who is the slave of her domestics. He may irritate and hinder by ill-judged interference, or he may leave matters to take their own course, as has usually been done; but any broad, well-planned policy is practically out of the question.

A further important consideration is that there is a large and increasing number of agricultural colleges and experiment-stations devoted more or less exclusively to scientific investigations for the benefit of agriculture. The United-States department of agriculture

should be the natural centre and regulator of this work, giving it a general unity, and preventing unnecessary duplication of experiments. Moreover, it is proposed to add to these, in the several states, so-called 'national experiment-stations,' in the conduct of which the commissioner of agriculture shall have at least an advisory power. It may be set down as certain, however, that the men who are conducting this experimental work, many of them eminent in their profession, will pay small heed to the advice of any commissioner whom they cannot respect as at least their equal in scientific attainments. We do not wish to be regarded as unfriendly to Col. Coleman. Judged by the previous history and present standing of the department, the appointment is an excellent one. What we desire to see is a new system, and only secondarily, and as a result of that, a new man.

DR. ADOLF DRONKE, director of the real-gymnasium at Trier, has lately published an elaborate paper on the place of geography as a science and in the school. While certain parts of it seem to us somewhat visionary, — such as the formation of an international academy of geography, the establishment of professorships of geography in all universities, and the adoption of an initial meridian in 20° west longitude, — the greater share contains suggestions that are at least valuable and practical, even if not altogether novel. Certainly there is much need of improvement in geographic instruction, as we have already pointed out. There is so general an agreement on this subject, that what we need now is not so much a discussion of what changes to make, as how to get the money for making them. Good maps and models, illustrations and specimens, as well as expensively taught and far-travelled teachers, are the first needs, but where do we find school committees ready to supply them?

AMONG THE WONDERFUL achievements of modern explorers should be placed on record the history of the successful expedition of Capt. Willard Glazier in search of the ultimate source of the Mississippi River. This daring explorer, at the head of a large and well-equipped party, penetrated the untrodden wilderness of central Minnesota, and reached Lake Itasca, which has so long been regarded as the source of the great river. Not content with this achievement, he plunged boldly into the forest, and succeeded, after great exertions, in forcing his way three miles farther southward, where he came to a second lake, also drained by the Mississippi, and forming, as he states, its uttermost head. To this lake he gives his own name, that the fame of his achievement may be perpetuated. It is perhaps unfortunate, that, as this whole region was sectionized by the general land-office several years previously, lines having been run at every mile, a prior claim to this great discovery may arise. In any case, however, the names of Capt. Glazier and John Phenix as explorers will go down to posterity side by side.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The new commissioner of agriculture.

In your notice, April 10, of the appointment of Col. Coleman to be commissioner of agriculture, you commend the selection because of his "knowledge of practical agriculture, and his experience of men and affairs," and indirectly condemn it because he does not have "any special or intimate acquaintance with the science of agriculture;" your idea seeming to be that the agricultural department should be organized as a 'scientific bureau, with a technical expert at its head.'

Col. Coleman has one additional qualification, in which he differs from all previous commissioners: he is without a pet hobby. His course will be to elevate the work of the bureau from the advocacy of some single theory, to the development of what is best in a variety of theories, and the adaptation of that best to the practical work of the agriculturist. To carry out such a course, it is not necessary that the head of the bureau should be a 'technical expert:' indeed, it is better that he should not be. Technical experts in one or two or three branches of scientific agriculture are, as a rule, those gentlemen who have bees in their bonnets, and seem to be incapable of such universal control as ought to be required; and experts in all branches cannot be found. If one have the ability to distinguish and recommend

what is best, to discover and make use of the ability of specialists, to restrain the disposition in any one department of his general work to override or belittle the rest, that one is the person to have charge as the general head. Such a person is Col. Coleman. His experience of men and affairs, and the general appreciation of his fitness in the conditions you pointed out, by all classes of men, prove the wisdom of the selection.

When the bureau is to be properly organized as a scientific one, will be after the so-called agricultural colleges, founded at so enormous an expense by the general government, shall have done what they were intended to do, — raise up young men and women, first, to an appreciation of what scientific agriculture is capable; and, second, to an educational ability to pursue and apply it. Until the old ruts are abandoned by men capable of understanding the benefit of a new and well-made road, such men to be those who are practical workers themselves, there will be no use of attempting science in a place the province of which is really only the collation, selection, and diffusion of such knowledge as can be used in the gradual development of all the resources of the country. When the work of such an education is begun at the right end, it will have its natural sequence in a higher gradation of the work of the head of the agricultural bureau, if any thing higher than that which will be accomplished by the new commissioner is needed.

AUG. F. HARVEY.

St. Louis, April 19.

Auroras.

Various speculations are met with from time to time as to the extent of any individual display of an aurora. A prominent French writer has recently attempted to show that auroras are not widely extended, and has instanced the case of the most brilliant aurora of modern times at Brussels, Belgium. This phenomenon occurred on Feb. 4, 1872; and the writer emphasizes the fact that it was not seen at Godthaab, Greenland. Meteorological observations at the latter place for this date are not accessible; but there is little doubt that, if there were such, it would be found that the sky was clouded, thus preventing the appearance. At all events, the observations made on the American polar steamer *Polaris*, which wintered about four hundred miles north of Godthaab, show the most brilliant aurora of the winter on Feb. 4. The same aurora was seen throughout the northern United States.

When we consider, that, as shown by Professor Loomis, during a maximum period of sunspots there are also the greatest number of auroras, and that great solar outbursts are followed or accompanied by magnetic storms and brilliant auroral phenomena, we are led to the view that the cause of the latter may be superterrestrial, acting either directly or indirectly through induced earth-currents.

It would seem as though all auroras are a manifestation of cosmic energy, and that their extent and brilliancy are limited by the amount of energy, by the vapor in the air, by the temperature, etc. Professor Lemström in Finland obtained a simulation of the aurora by artificial means during one winter; but during the next winter, which was barren of brilliant auroras, both he and Professor Tromholt, the latter in Iceland, failed in this. It may be that the first success was owing as much to earth-currents, or a condensation of atmospheric electricity, as to the artificial means employed.

The question of the source of the electricity of an aurora is an important one in meteorology; and

the fact that thus far all attempts at connecting auroral phenomena directly with meteorological have failed, goes far to show a cosmic rather than a terrestrial origin for the aurora.

H. A. H.

An extinct hydroid.

Whether Shakspeare was the first to give expression to the idea of 'Sermons in stones,' the writer of this notice is not scholarly enough to answer. Strongly impressed by many demonstrations of its truth, it is in no spirit of detraction that he ventures the opinion that the inspired bard could not have appreciated the significance of his declaration, if we take into consideration what these sermons have since revealed to us of the past history of the world. The rocks have proved to be volumes of the most convincing sermons, and every pebble has a story that may be read. Such a pebble, the subject of the present communication, was sent to the writer by a greatly esteemed friend, the well-known naturalist and philologist, Prof. Samuel S. Haldeman, shortly before his death. It was picked up in Lebanon county, Penn., but exactly at what locality I failed to inquire. It is an irregular rectangular piece of quartzite, about an inch and a quarter in two diameters, and half an inch in the third diameter. It has several conchoidal fractures, is water-rolled, with rounded edges, and smooth. It is dirty white, opaque, homogeneous, and of flinty texture. Embedded in it, scattered here and there, are seen several dozen little fossils, all of the same character, and worn level with the smooth surfaces of the pebble. Most of the fossils have the form of a narrow ellipse with acute extremities, or have the shape of a section of a double convex lens. Where they cross the edges of the pebble, they exhibit the same form of outline on the contiguous surfaces; so that, if isolated, they would appear to be actually lenticular in form. They are composed of smoky-colored quartzite, cross-banded with white, and contrast conspicuously with their matrix. My first impression, on seeing the pebble, was, that the fossils were rhizopods, related to the nummulites; but an inspection with a lens indicated them probably to be hydroids related to the graptolites, and especially to *Phyllograptus*. The lenticular sections of the fossils generally range from four to nine millimetres in length by one to one and three-eighths millimetres in thickness at the middle. As represented in the accompanying figure, the white bars crossing the short diameter of the lenticular sections are produced by what appear to be two rows of cells, with their bottoms applied together inwardly, and separated by a median, slightly undulating line. Many of the cells are flask-shaped, with the neck directed outward, and reaching the convex surface of the fossil. In others the neck is variably shorter, and in some appears to be absent, the difference apparently being dependent on sections of the cells at different levels. In the specimen figured, the beaked cells appear somewhat curved or retort-like, but in other specimens they are straight. The body of the cells mostly exhibits a nucleus of smoky hue, while the walls of the cells are white, though not sharply defined from the nucleus. The appearance seems to be due to the interior of the cells being occupied by



HALDEMANA
PRIMAeva.

a more translucent deposit of silex. In several of the fossils like the one figured, the number of cells in each row is about two dozen. The lenticular sections of the fossils are not all equally symmetrical with the one figured, some bulging more on one side than the other, and a few being thicker towards one pole than the other, and less acute at the end. Two specimens, of which one is eleven millimetres long, are slightly constricted near the middle, and look like conjoined pairs. Another specimen, unlike the others, extends across the pebble for about eighteen millimetres, is of nearly uniform width throughout, and is broken near the middle. One extremity curves laterally, and ends in an obtusely rounded manner; the other extremity extends obliquely in an opposite direction, tapers a short distance, and is then prolonged to a broken end.

From the well-known graptolites of the Silurian rocks, our fossil differs especially in the cells being embedded in a common basis or matrix, in this respect resembling such polyzoa as *Cristatella* in comparison with *Plumatella*. The age of the fossil I am unable to read in the pebble, though doubtless others may be able to do so. In Lebanon county the prevailing rocks are of lower Silurian age; and it is probable the pebble pertains to one of these, though it may have travelled from another source. The character of the fossil appears to be different from any previously indicated; and I would propose to name it *Haldemana primaeva*, in memory of the one who called our attention to this interesting representative of the hydroids.

JOSEPH LEIDY.

Phosphatic rocks of Florida.

In my 'Report on cotton-production in Florida,' vol. vi. of the quarto series of census reports, p. 14 (194), there is an analysis, by Dr. G. W. Hawes, of a building-stone from Hawthorne, Alachua county. This rock contains 16.02% of phosphoric acid; and it was considered as of eocene or oligocene age, like the rest of the limestone of the peninsula.

During the past winter, Mr. L. C. Johnson of the U. S. geological survey has been collecting in Florida, and has made a very important discovery. He finds that the building or chimney rock in several of the counties of the state, and probably wherever it is found, like that occurring at Hawthorne, is generally phosphatic. Specimens sent to me for examination by Mr. Johnson, from Suwannee, Levy, Alachua, and Marion counties, are strongly phosphatic, varying in content of phosphoric acid from five to ten per cent. The material which contains most phosphoric acid is a porous, soft rock, consisting in the main of grains of quartz, with occasionally a little carbonate of lime, but seldom very much. In some of the specimens, especially those from near Waldo, the soft friable rock contains small nodular masses of nearly pure phosphate of lime disseminated through it. The largest of these nodules is some two inches in diameter.

By the discovery of a highly fossiliferous bed near Waldo, Mr. Johnson has been able to fix the age of these phosphatic rocks as miocene or later; and this view is confirmed by the specimens from Rock Spring in Orange county, collected by me in 1880, which Professor Angelo Heilprin determined from the fossils to be miocene. I have recently tested all these specimens, and find them, without exception, highly phosphatic.

From these facts, and others presented in the subjoined letter of Mr. Johnson, it appears that the deposits of miocene age are generally spread over the Florida peninsula, if indeed they are not co-extensive with those of the oligocene.

This will lead to a modification of some of the views advanced in my census report above referred to, concerning the past geological history of the peninsula, and the origin of the high hummocks; for these hummocks, in part at least, are produced by the action of the *miocene* phosphatic limestone, and not the *oligocene*, upon the prevailing sandy soils.

And, similarly, the much wider distribution of these *miocene* rocks proves that a much larger proportion of the peninsula was submerged after the *oligocene* period than I at one time supposed.

We shall look with the very greatest interest for the results of Mr. Johnson's investigations of the rocks of the western coast of Florida, in Hernando and Hillsborough counties.

I may add that none of the specimens of the upper *oligocene* or Vicksburg limestone, either from Florida or Alabama, which I have examined, show more than a slight trace of phosphoric acid.

EUGENE A. SMITH.

University of Alabama, April 20.

It might have been hasty, without books, and without sufficient opportunity for comparison, to have pronounced the phosphatic rocks of Preston's Sink, Fort Harlee, *miocene*, or not older. I now think it later still; but always with the reservation that I may be permitted to change my mind upon a more careful study, under circumstances more favorable, and also deferring to the opinion of Dr. White, who already has such favorable opportunities, when he can get time to take up the subject, with all my collection before him.

The location of these phosphates is of more immediate import to you and me. But, on the question of the horizon, I ask the consideration of the facts and specimen already sent you. The 'Nigger Sink' at Downing's, in this vicinity alone, ought to set the question at rest.¹ There you find *in situ*, and exhibiting their due relations, the *oligocene* limestone at the base, and finally, after various intermediate deposits, a hundred and fifty feet above, the siliceous phosphatic rock, exactly similar to that sent you from the quarry at Gainesville, from Liveoak, and which is found in this oak and hickory region on the top of every hill.

There, also, you find two fossils,—the *Ostrea*, found also at Hawthorne and in the Wacahootie region, Marion county, always underlying the phosphates, and above the *Orbitoides* and *Pecten* of the limestone; and the other, the great coralline, of which I could mail but a fragment. This last is seen *in situ*, so far as I am now informed, nowhere but on the tops of these hills, overlooking the Natural Bridge of Santa Fé.

The Fort Harlee marl, near Waldo, is quite different from the phosphatic rock I have been sending you from so many points. It has all its shells, or casts of shells, intact. The vertebrate fossils, however, seem the same; that is, the sharks' teeth and saurian remains are alike. The phosphatic rock has lost all its fossil shells. That these once existed, is clear from the fact that occasionally a trace may be found. If not the same, then how are they related? The argument must be postponed; but to me the conclusion is clear that the Waldo bed is newer than the others. All the others, from the texture of the rock, the obscure traces of shells, the chemical constituents, and from the surroundings, may be classed as one.

¹ Three others, heretofore explained, — Simmons at Hawthorne, Sullivan old field, and the devil's mill-hopper, — sustain the same conclusions, and none contradict.

The great extent of the formation, and the uniformity of the rock, are still very remarkable.

Undoubtedly it is the same rock seen near Ocala, where the limestone is not visible, at Hawthorne, at Gainesville, at Newmanville, at two or three knolls in the vicinity of Liveoak, and on innumerable others all over this central region of *oligocene* sinks. Strangely, too, the knobs are uniformly of a height of about sixty feet above the surrounding flats and depressions marked by the cherty limestone. It would be interesting and valuable, if I had the means in my power, to locate and measure the extent of every one of these deposits. Your own census report, giving the extent of hummocks, and oak and hickory soils, east of the great chain of sand-dunes from Apopka northward, and west of the lake region, is the nearest means I can suggest for making an approximate estimate.

LAURENCE C. JOHNSON.

Newmanville, Fla., March 22.

Do telegraph-wires foretell storms?

Probably some thousand Americans have noticed the automatic storm-signalling of wires by sound-vibration. I allowed a telephone-wire to remain for a long time attached to one corner of my (frame) house because of its practical utility as a weather-prophet. When not a leaf was stirring in the neighborhood, and not a breath to be felt, the deep undulations were audible in almost every room, although mufflers had been duly applied. Before that, some hours in advance of every severe storm, the upper story was hardly inhabitable on account of the unearthly uproar, which would have made a first-rate case for the Society for psychical research.

The warning that it gave varied from six to twelve hours, rarely exceeding the latter; and I do not think it ever warned in vain. When the storm actually came, the noise nearly always ceased. It never was noticeable in the warmer part of the year; and through the heat of midsummer it was silent. I cannot recall any exception to this. Its climax of clamor was reached some hours before the 'electric storm,' as it was called, of November, 1882. But all through two winters and the proximate parts of autumn and spring I found it a trustworthy and self-announcing storm-signaller, which left me abundant time to prepare. I had it removed, finally, because there was sickness in the house, and its doleful prophecies were not appreciated.

I explained the phenomenon, partly at least, by the effect of very distant air-impulses transmitted in sound-waves from wire to wire, after the manner of the acoustic or mechanical telephone. Yet this does not seem quite adequate, when one considers how far those vibrations must have travelled to outstrip a storm by hours; and yet how much energy and sonorosity they retained when they reached me!

WM. H. BABCOCK.

Washington, April 16.

[We have good authority for saying that the vibrations of the telephone and telegraph wires here referred to are certainly not due to electric currents, nor to the minute acoustic waves of the mechanical telephone, but are simple transverse vibrations and longitudinal waves such as occur on every stretched cord that gives out a musical note. These vibrations are ultimately caused by the wind. For any given wire stretched in a permanent location, there will undoubtedly be a certain direction and character of wind that will call forth its loudest tones. Our correspondent's wire may be specially influenced by the south-

erly winds that precede storms. Sometimes rapid alternations of sunshine and shade, by heating and cooling the wire, cause it to elongate and contract rapidly, and maintain an additional series of musical notes. Sometimes the length and tension of a wire stretched between two telephone supports is such that it can harmonically respond to several classes of waves transmitted from distant parts of the line. We thus obtain the very rich effects of the aeolian harp, which, as is well known, has often been said to ring out the finest notes before a storm, and whose action was also attributed to magnetism and other occult causes, until Chladni gave the correct explanation. — Ed.]

An attempt to photograph the solar corona.

Mr. W. H. Pickering having called my attention to his letter entitled 'An attempt to photograph the solar corona,' printed in *Science* for April 3, may I ask you to insert the following lines in the next number of your journal.

The false coronal effects which Mr. Pickering describes are precisely those which might have been expected to result from his optical and instrumental methods. I have in my papers called special attention to the two principal sources of false effects which are present in the form of apparatus employed by Mr. Pickering; namely, the use of a lens, and the position of the drop-shutter which is said to have been 'attached to the lens.'

In some early attempts which I made with lenses, any true coronal effect which may possibly have been upon the plates was completely masked by very strong false coronal appearances and rays, similar to those obtained by Mr. Pickering. These were due, probably, in part to outstanding chromatic aberrations of the lenses, though corrected for photographic work, in part to reflections from the surfaces of the lenses, and in part to a diffraction annulus about the sun's image. It was on account of these, and some other probable sources of error when a lens is used, that I had recourse to reflection from a finely polished mirror of speculum metal. When the mirror was used, all these false effects disappeared.

It is scarcely necessary to remind your scientific readers that the only position in which the drop-shutter can be placed, when an object so bright as the sun is photographed, without introducing strong false coronal effects about the sun's image from diffraction, is in, or very near, the focal plane. 'Attached to the lens,' whether behind or in front of it, a strong diffraction effect is produced upon the plate at the beginning, and again towards the end, of the exposure. If Mr. Pickering will direct his apparatus to the sun, and observe the sun's image on the ground glass of the camera during the time that the drop-shutter is moved very slowly past the lens, he will be the spectator of a succession of fine diffraction effects, which in the aggregate, as far as they were bright enough, must have recorded themselves on his plates. In this way, with care and skill, the sources of other instrumental effects could, no doubt, be tracked out.

In one of my papers my words are, "The moving shutter, being placed very near the sensitive surface, and practically in the focal plane, could not give rise to effects of diffraction upon the plate." I may now add, that, even with the shutter near the plate, care has to be taken that no light is reflected from the edge of the moving plate of the shutter.

I state that with my apparatus, when the sky is free from clouds, but whitish from a strong scattering

of the sun's light, "the sun is well defined upon a sensibly uniform surrounding of air-glare, but without any indication of the corona. It is only when the sky becomes clear and blue in color that coronal appearances present themselves with more or less distinctness." Any apparatus intended for photographing the corona must fulfil perfectly these conditions before any serious attempts are made to obtain the corona.

I stated, in a paper presented to the British association for the advancement of science in the summer of 1883, that I had discarded the use of colored glass (or cells of colored solutions) because of the danger of false appearances from imperfections in the surfaces or in the substance of the glass.

Mr. Pickering does not state that his sensitive plates were 'backed' with a solution of asphaltum, or other black medium, in optical contact with the glass, — an essential condition.

No tube, with suitable diaphragms inside, appears to have been used in front of the lens to prevent light falling upon the inside of the telescope tube or camera, and being thence reflected possibly upon the plate. The desirable precaution of using a metal disk, with a suitable surface, a little larger than the sun's image, and placed close in front of the sensitive plate, does not seem to have been taken.

Mr. Pickering says of the violet glass, "By its use, a negative image of the sun's disk was obtained; but without it, the plate gave a reversed image." I found no difficulty in obtaining a negative, or a reversed image, when violet glass was used, by a suitable change of the time of exposure; and therefore Mr. Pickering's time of exposure was in fault, if he wished a different result.

Mr. Pickering says, "Both bromide and chloride plates were provided; but, as with Mr. Huggins, the latter proved to give much the better coronal effects." And again, towards the end of the letter, he says that "chloride plates are more suitable than bromide ones for obtaining an atmospheric corona, just as Mr. Huggins has claimed that they are more suitable for taking a solar one: hence I think one must not rely too much on the ultra-violet sensitiveness of the chloride plate for the separation of the two." Passing by the use of the words 'atmospheric corona' for the false appearances which were due in great part, if not altogether, to diffraction and other instrumental effects, as I have already pointed out, and presuming that Mr. Pickering was not unfamiliar with the greater blackness of chloride plates, especially when developed with ferrous oxalate, he seems to infer some special suitability of the chloride plates to bring out the false effects upon his plates. It may be suggested that Mr. Pickering seems to have used the same length of exposure throughout, "giving an exposure which may be estimated at about a fifth of a second." Now, it is scarcely probable that the bromide and chloride plates possessed the same sensitiveness; and it may have been that the (probably) more sensitive bromide plates were thin from excessive exposure. It may even have occurred that his lens, if corrected for bromide plates, gave an outstanding aberration about H, or a little beyond. Anyway, until these and some other similar points are cleared, it does not seem to me that Mr. Pickering is justified in making the insinuation which seems to lie in the words which I have quoted.

In conclusion, I cannot refrain from expressing great surprise that Mr. Pickering should have mentioned my name in connection with experiments carried out in complete disregard of the conditions to which I had called attention, as essential in a matter

of such extreme delicacy as photographing the corona, and in which no little skill and special experience are necessary on the part of the *photographer* as well as on the part of the physicist.

Mr. Pickering has no doubt received authority from Dr. O. Lohse to say that "he (Dr. Lohse) considers that the halo on his plate is wholly atmospheric, and not coronal;" but Dr. Lohse's published statement reads differently. Dr. O. Lohse's words are, "Es gelang aber dieselben (die schwierigkeiten) zu überwinden und resultate zu erhalten welche zu einer fortsetzung der — hier freilich selten möglichen und mit grösserem vorthail in möglichst hoher lage anzustellenden — experimenten ermuthigen." — *Vierteljahrsschrift der Astronomischen gesellschaft*, xv. 134.

I have not seen Dr. Lohse's plates, and can therefore express no opinion as to the nature of the appearances upon them. WILLIAM HUGGINS.

THE PRESERVATION OF NIAGARA.

NEARLY seven years ago Lord Dufferin, then governor-general of Canada, suggested to Gov. Robinson of New York that the governments of the province of Ontario and the state of New York should purchase such lands about Niagara Falls as would be required to give free access to the principal points of view, and serve to restore and preserve the natural scenery of the great cataract, beside securing to visitors freedom from those vexatious annoyances which now abound. Subsequently the governor-general called the attention of the government of Ontario to the matter, and recommended co-operation with the state of New York in accomplishing this purpose.

Later, in January, 1879, Gov. Robinson, in his annual message to the legislature of New York, presented this matter, and recommended the appointment of a commission to investigate the question, to confer with the Canadian authorities, to consider what measures were necessary, and to report the results to a succeeding legislature.

By resolution the commissioners of the state survey were charged with the investigation. This commission included some of the most distinguished men of the state, — Ex-Gov. Horatio Seymour, Vice-President of the United States W. A. Wheeler, Lieut.-Gov. Dorsheimer, President Barnard of Columbia college, and others.

With breadth of view worthy of such men, they state in their report, that, "under this resolution, it became the duty of the commissioners to ascertain how far the private holding of land about Niagara Falls has worked to public disadvantage through defacements of the scenery; to estimate the tendency to

greater injury; and, lastly, to consider whether the proposed action by the state is necessary to arrest the process of destruction, and restore to the scenery its natural character." In pursuance of these objects, the commissioners instructed Mr. James T. Gardiner, director of the state survey, to make an examination of the premises, and prepare for their consideration a project. He was assisted in this work by Mr. Frederick Law Olmsted, the distinguished landscape-architect.

The examination showed that the destruction of the natural scenery which forms the framework of the falls was rapidly progressing: unsightly structures and mills were taking the place of the beautiful woods that once overhung the rapids; the fine piece of primeval forest remaining on Goat Island was in jeopardy from projects looking to making a show-ground of the island; and every point from which the falls could be seen on the American side was fenced in, and a fee charged for admission. It was found, that, owing to the topography of the main shore, it was practicable to restore its natural aspect by clearing away the buildings from a narrow strip of land 100 to 800 feet broad and a mile long, and planting it with trees which would screen out from view the buildings of the village. When these trees should be grown, and the mills removed from Bath Island, and trees planted there, the falls and rapids would be again seen in the setting of natural foliage which formed so important an element in their original beauty. Every point from which the falls could be seen would also become free of access by the plan proposed. A map was made showing just what lands should be taken to carry out these purposes. The commissioners adopted the plan of Mr. Gardiner and Mr. Olmsted, and recommended to the legislature of 1880 the passage of an act to provide for acquiring title to the necessary lands by the exercise of the right of eminent domain, leaving it to a future legislature to consummate the purchase by appropriating the amount for the payment of the awards, if the sum should seem a reasonable price for the property. Such an act passed the assembly, but was defeated in the senate, although the movement was supported by petitions signed by the most distinguished men of this and other countries. The report of the state survey, with its complete descriptions, illustrations, and maps, then became the basis of a systematic effort on the part of a few determined friends of the falls to educate and arouse public opinion to save the scenery of Niagara. Early in 1883 this

movement ripened into the organization of an association to promote legislation for preserving the scenery of the Falls of Niagara, Mr. Howard Potter of New York being president, and Hon. J. Hampden Robb, chairman of the executive committee.

Through the efforts of this Niagara-Falls association, an act was passed, in 1883, providing for a commission entitled 'The commissioners of the state reservation at Niagara,' and giving them power to proceed through the courts to condemn the lands needed. Ex-Lieut.-Gov. William Dorsheimer is the president of this board; and the other members are President Anderson of Rochester university, Hon. J. Hampden Robb, Hon. Sherman S. Rogers, and Andrew H. Green. With some modifications made necessary by changed conditions, they adopted the plan proposed by the state survey. The lands selected were then surveyed, and their value appraised by a commission of very high character, appointed by the court, the total valuation of the lands being \$1,433,429.50. The report of the commissioners of the reservation was made to the present legislature, and a bill to appropriate this sum was introduced. The Niagara-Falls association worked in every part of the state to arouse public opinion to the importance of making this appropriation, and the commissioners labored most earnestly among the legislators and the people. The battle was a hard one against ignorance and narrow-minded selfishness; but the victory is complete. The legislature, by more than a two-thirds majority, has appropriated the \$1,433,429.50, and the governor has approved the act.

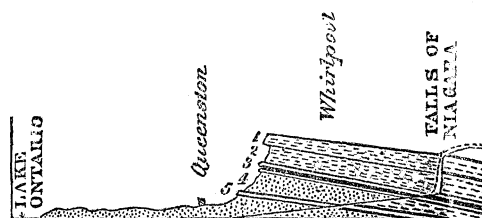
After six years of almost continuous effort on the part of the active friends of this enlightened project, it is secured by a law which declares that the lands are purchased by the state in order that they may be 'restored to, and preserved in, a *state of nature*,' and that every part of them shall be forever free of access to all mankind.

THE NIAGARA GORGE AS A CHRONOMETER.

THE recession of the falls of Niagara will be understood by reference to the accompanying figure.

The strata, as will be seen, dip gently (twenty-five feet to the mile) toward the south. The upper stratum (No. 1) consists of compact Niagara limestone about eighty feet in thickness. Underneath it (No. 2) is the com-

paratively soft Niagara shale of about the same thickness. Nos. 3 and 5 are also strata of hard rock, with a softer rock intervening. The river formerly plunged over the escarpment at Queenston, about seven miles below the present cataract, and where the perpen-



SECTION OF THE STRATA ALONG THE NIAGARA RIVER, FROM LAKE ONTARIO TO THE FALLS.

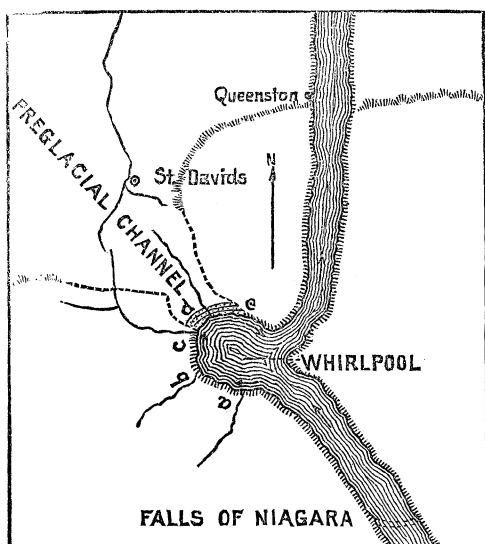
dicular fall must have been upwards of three hundred feet. From that point to the present cataract, the river now occupies a narrow gorge from five hundred to twelve hundred feet in width, and from two hundred and fifty to three hundred and fifty feet in depth. The manner of the recession is easily understood from a glance at the diagram. The softer rocks (Nos. 2 and 4) rapidly wear away, thus undermining the harder rocks above, and leaving them to project over, and finally to break off in huge fragments, and fall to the bottom, where they would lie to obstruct the channel, were it not for the great momentum of water constantly pouring upon them, and causing them to grind together until they are pulverized and carried away piecemeal. The continuity of the underlying soft strata insures the continuance of a projecting stratum at the top, and a perpendicular plunge of the water when passing over it.

Double interest attaches itself to the Niagara gorge, when we consider the evidence of its post-glacial origin, and thus are permitted to regard it as a chronometer of the glacial age.

That the Niagara River can have occupied its present channel only since the glacial period, was shown by Professor Newberry when he proved that the Cuyahoga River, emptying into Lake Erie at Cleveland, occupied in preglacial times a channel about two hundred feet below its present bed, borings in the bed of the Cuyahoga extending that distance in glacial clays before reaching the rock. To receive a tributary at that depth, the level of Lake Erie must, of course, have been correspondingly depressed; and, as the lake is nowhere much more than two hundred feet in depth, we may confidently say, that, before the glacial period, such a body as Lake Erie did not exist, but

instead a wide valley through which a great stream, corresponding to the present Niagara, found its way to the head of Lake Ontario, through a deep and continuous gorge. Professor Spencer, indeed, thinks he can trace the course of this preglacial gorge from near the mouth of Grand River in Canada, northward to Lake Ontario.¹

We might also infer the relatively late origin of the present channel of the Niagara from the small amount of work which the river has done in its present channel. The Allegheny and Ohio rivers, which lie outside the limit of glaciation, illustrate in a striking degree the extent of *preglacial* erosion. For a distance of more than a thousand miles, these streams occupy a continuous eroded trough, averaging about a mile in width and from three hundred to five hundred feet in depth; whereas the gorge in the Niagara River below the falls is only about seven miles in length.



That the Niagara gorge is post-glacial, was also shown as early as 1841, by Professor James Hall of the New-York survey, who pointed out to Sir Charles Lyell² the probable course of a preglacial channel, now filled with glacial *débris* extending from the whirlpool to St. David's, where the level of Lake Ontario is reached. A glance at the accompanying cut will explain the situation. From the falls to Queenston, the perpendicular bank of the gorge, from two hundred and fifty to three hundred

feet in height, is continuous upon the east side; but upon the west side, about halfway down, occurs a remarkable indentation known as the 'whirlpool.' Following this bank around, the small streams *a*, *b*, and *c* expose the rock before descending to the whirlpool, and the rocky bank re-appears at *e*. But between *c* and *e* no rock appears, although the stream *d* has worn a channel from fifty to a hundred feet deep. The sides and the bed of *d* consist of the familiar glacial deposit called 'till,' or 'boulder clay.' The distance from *c* to *e* is about five hundred feet. Following up the channel of *d*, one comes, at the distance of a half-mile, to the general level of the banks of the river above the cataract, and of the escarpment of Niagara limestone, from which the river emerges at Queenston. The opening of the supposed pre-glacial channel to the northwest is, as is shown in the plate, much wider than its entrance at the whirlpool, and the descent of three hundred feet to St. David's is rapid. The broad opening toward St. David's is also filled with gravel rather than with till; and this gravel extends southward over the higher level towards the falls, somewhat like the familiar 'lake-ridges' of Ohio.

It will be seen that the existence of a preglacial channel from the whirlpool to St. David's—a distance of about three miles—is somewhat hypothetical, since for a space of two miles the original features of the country are wholly disguised by the glacial deposit, and no wells have been sunk to a sufficient depth to test the question properly. The well to which Sir Charles Lyell referred was probably about the head of the stream *c*, which is really in the gravel outside the escarpment. Still there is little doubt that before the glacial period there was a narrow gorge, about two hundred and fifty feet deep, extending from the whirlpool, and perhaps a little above it, to the Ontario level at St. David's. But it is equally clear that the river which wore this gorge was not the Niagara, since a stream of that size must, during the long preglacial period (measured by the eroded channel of the Ohio and Allegheny), have worn a gorge far longer than that between the whirlpool and the present falls. The preglacial channel from the whirlpool to St. David's was probably, therefore, as Dr. Pohlman suggests, the work of a comparatively small stream, with a drainage basin occupying not more than two or three counties in western New York.

Considering, now, the gorge from Queenston to the falls of Niagara as the work done by the stream since the close of the glacial period, and

¹ See Second geological report of Pennsylvania, Q⁴, pp. 359 sq.

² Lyell's Travels in America (first series), vol. i. p. 27.

taking that as the dividend, if we can determine the annual rate at which the falls recede, and take that for the divisor, our quotient will represent the time that has elapsed since the glacial period. The accompanying map gives a more definite idea of that divisor than we have ever before had. The lower dotted line represents the margin of the horse-shoe fall as mapped by the New-York geological survey in 1841, under the direction of Professor James Hall. The upper line is that made in 1875 for the U.S. geodetic survey. By comparing the two, a pretty correct calculation may be made as to the amount of recession of the horseshoe fall in the interval of thirty-four years. This cannot vary much from a hundred feet upon the whole line, being, as the commissioners calculate, two hundred and seventy feet at certain points.

Until this last survey, the attempts to estimate the time required for the cataract to recede from Queenston to its present position have been based upon very insufficient data. Mr. Bakewell, an eminent English geologist, gave personal attention to the problem as early as 1830, and, from every thing he could learn at that time, estimated that the falls had receded about a hundred and twenty feet in the forty years preceding. He recurred to the problem again in 1846, 1851, 1856 (*American journal of science*, January, 1857, pp. 87, 93), and was each time confirmed in the belief that the apex of the horseshoe fall was receding, on an average, three feet a year. On the other hand, Sir Charles Lyell, upon his first visit, in 1841, 'conceived' (upon what basis he does not tell us), that, at the utmost, the rate could not be more than one foot a year, which would give us thirty-five thousand years as the minimum time. But, as it appears, the result of the recent survey is to confirm the estimate of Mr. Bakewell, thus bringing the period down to about seven thousand years.

Two elements of uncertainty, however, tending to lengthen the estimate, should be noticed. In the first place, the recession may have been somewhat slower while the hard stratum, No. 3, was exposed. In the second place, the deposits of gravel running southward from St. David's, and corresponding to the lake-ridges, indicate that subsequent to the glacial period this whole region was slightly submerged beneath a shallow body of water; in which case, the recession of the gorge would have begun only upon the emergence of the land. And we have no means of telling how long an interval may have elapsed between the withdrawal of the ice and the withdrawal of the water.

On the other hand, it is probable that the channel of the preglacial stream extended somewhat above the whirlpool, thus reducing amount of work done since glacial time.

The above estimates are confirmed, also, by the small amount of change that has taken place in the species of animals during that period. The mollusks found in the river above the falls at the present time, are identical species with the shells found in the deserted river-channel at the top of the escarpment opposite the whirlpool, while nearer the falls the bones of the mastodon have been found in the same deposits; all which corresponds with a vast amount of other evidence, going to show that the present species are, in the main, identical with those existing at the close of the glacial period. The theory of evolution is relieved from a heavy burden by supposing a recent date for the close of the glacial epoch; for the changes since that epoch have been so slight, that the time allowed by the physicists is insufficient for the whole development of organic forms, unless the rate of change is more rapid than must be the case if the glacial period is thrown very far back.

G. FREDERICK WRIGHT.

NIAGARA FALLS CONSIDERED AS A SOURCE OF ELECTRICAL ENERGY.

THE first suggestion of the possible employment of Niagara Falls as a source of electrical energy, and the distribution of this energy in the shape of light and power, is due to C. W. Siemens. It was a large suggestion; and it took root speedily in what may be termed 'cosmical minds.' The way, however, to its fulfilment, has not been made plain to business enterprise. The most noteworthy remarks upon the subject were made by Sir William Thomson in 1881, at the York meeting of the British association. His remarks and calculations were in substance as follows: With the idea of bringing the energy of Niagara Falls to Montreal, Boston, New York, and Philadelphia, a total electromotive force produced by the dynamo-machines at the falls was taken at 80,000 volts. This was between a good earth connection at the falls, and one end of a solid copper wire of half an inch in diameter, and three hundred statute miles in length. The resistance of the circuit was so arranged that there should be an electromotive force of 64,000 volts at the remote end, between the wire and the earth connection. The calculations showed that a current of 240 webers

would be produced in the wire, which would take energy from the Niagara end at the rate of 26,250-horse power, and only 5,250-horse power would be lost by the generation and dissipation of heat through the conductors; and thus 21,000-horse power would be available at the cities above mentioned. According to Sir William Thomson's calculation, it will be seen that eighty per cent of the energy would be thus transmitted. He also supposed that the solid copper wire was supported, like the ordinary telegraph-wire, upon poles, and found that an electric spark would not be produced between wires electrified to the difference of potential of 80,000 volts, unless they were within three-quarters of an inch apart: there could not be, therefore, great difficulty in the insulation. The cost of the copper conductor was reckoned at \$185,000; and the interest upon this at five per cent is \$9,500 a year.

At the time these remarks were made, great hopes had been excited by the invention of the Faure storage-battery; and Sir William Thomson closed his address by a glowing picture of the possibility of keeping a Faure battery of 40,000 cells constantly charged, we will say in New York, and applying a methodical system of removing sets of 50, and placing them upon local supply-circuits, while sets of 50 are replaced upon the main conductor.

The electromotive force of a Faure cell is in the neighborhood of 2 volts; and 50 cells would give 100 volts, which would be sufficient to supply several arc-lights. Thus the great electromotive force of 80,000 volts could be subdivided. Unfortunately, however, it has been found that the Faure battery is not permanent, or even fairly so. It can be said, without exaggeration, that its working-life is less than a year, and during the time of its best estate it cannot be depended upon. Many attempts have been made to perfect the Faure cell, and other forms of electrical accumulators; but no form of storage-battery is a commercial success at this present writing. It is not, however, beyond the power of invention to devise a system of what are called step-down dynamo-machines, by means of which the great difference of potential of 80,000 volts can be subdivided and utilized on different circuits. A number of small dynamo-machines could be connected with the great copper conductor leading to Niagara Falls in such a manner that the energy transmitted by this conductor could be distributed over a large extent of territory, either in the shape of light or power.

The distribution of light from a great central

station has already been accomplished. The system of village-lighting devised by Edison can now be studied by those who are interested in the employment of the energy of Niagara Falls for a similar purpose. The limitations of distance apply to the present central electric-lighting stations; and those who are sceptical in regard to the great plan of utilizing Niagara Falls as a source of energy make a strong point when they ask why the system of great central stations has not been rapidly increased. It is true that abundance of water-power takes the place of coal; but the cost of the long conductors, the maintenance of the insulation, and the interest on the cost of any method of subdivision, must also be considered, and may be found to offset the cheapness of the source of the energy. We imagine, moreover, that few towns or cities would be willing to depend for their light on a seat of energy so remote as even fifty miles, to say nothing of three hundred. An accident to the copper conductor, due to the falling of a tree, or to some mischievous action, could plunge a city into darkness. If the conductor were placed underground, defective insulation would enter, and produce the same result. Even if the system of utilizing Niagara Falls as a source of electrical energy should be adopted, a supplementary system of lighting would have to be maintained in every city.

It is not safe to assume, that, if this large scheme of utilizing Niagara Falls could be made successful, business enterprise would already have moved in this direction; for capital, it is well known, is extremely conservative. The true reason that large sources of water-power have not been utilized for electric lighting on a large scale, is due to the fact that the small details, and what are called the small items, assume great proportions, and bid fair to consume all profits which come from a saving of coal. Thus the city of Buffalo could have been lighted by the utilization of the water-power along Niagara River; and we cannot believe that the failure to do so has been due either to the opposition of the gas companies, or to the lack of imagination of capitalists. In short, the facility with which energy in the shape of coal can be transported from place to place counterbalances at present the cheapness of a very remote source of energy in the shape of a waterfall.

The reasons for and against the utilization of the energy of Niagara Falls as a source of light apply also to the question of the electrical transmission of power, with this exception, that the electrical transmission of power has

not reached even the perfection which systems of electrical lighting have attained.

JOHN TROWBRIDGE.

DR. GOULD'S WORK AT THE CORDOBA OBSERVATORY.

[THE Boston papers of last week Thursday gave a full account of the complimentary dinner given to Dr. Benjamin A. Gould on his return to this country, after the completion of his long series of observations in the Argentine Republic. We place before our readers that portion of the address made by Dr. Gould after the dinner, which narrates the history of his undertaking, on which he has expended nearly fifteen years. Want of space prevents our giving the introductory remarks in response to the warm welcome which he received from his hosts, or the many other excellent addresses upon the occasion.]

The undertaking began, as you know, with the project of a private astronomical expedition, for which my friends in Boston and vicinity had promised the pecuniary means. The selection of Cordoba as an especially desirable place was chiefly due to our lamented countryman, Gilliss, whose astronomical mission to Santiago de Chile had resulted in extensive and valuable observations of southern stars, and in the establishment of a national observatory, while it had enabled him to form a sound judgment as to the relative advantages of different points in South America for astronomical purposes, notwithstanding the total want of trustworthy meteorological data. This choice of place was confirmed by the counsel of the Argentine minister to this country. That minister was Sarmiento, a man who needs no encomium here; for during his brief residence in the United States he gained an exceptional number of friends and admirers. He transmitted to his government, then under the presidency of Gen. Mitre, my application for certain privileges and assurances, all of which were at once cordially conceded; but his interest in the plan became furthermore so great, that when, soon afterwards, he was himself elected president, he obtained the assent of the Argentine congress to the establishment of a national observatory, and wrote asking me to change my plans accordingly. The official invitation was sent in due time by the minister of public instruction, Dr. Avellaneda. The government assumed the expense of the instruments and equipments already bespoken, and authorized the engagement of the requisite assistants.

In 1874 Dr. Avellaneda succeeded Sarmiento in the presidency, and in 1880 he was himself succeeded by Gen. Roca. Thus four successive administrations have encouraged and sustained the undertaking; and notwithstanding the high political excitement which often prevails, and might easily have disinclined the members of any one party to give cordial aid to institutions established or fostered by their opponents, there has never been wanting a spirit of decided friendliness to the observatory, and to the scientific

interests which have been developed under its auspices. No president of the nation, and no minister of the department under which the observatory is placed, has failed to give strong practical evidence of his good will. There has been none of them to whom I do not owe a debt of gratitude. I have never made an official request which has not been granted, and in such a way as to enhance the favor. And just as the official founders of the observatory met us with a cordial welcome on our arrival, so the government of to-day has overwhelmed me with kindness, and tokens of regard, on my departure. On the very last evening before embarking, when it was my privilege to receive the farewells of a crowded assemblage in the halls of the Argentine geographical institute, and to hear words of sympathy and commendation from the lips of Gen. Sarmiento, my earliest Argentine friend, speaking in behalf of that society, I replied in the few words which alone were possible at the time, but with all sincerity and truthfulness, as follows:—

“It was you, sir, who provided the opportunity for which I was yearning: it was the Argentine Republic which made it easy for me to avail myself of it. It has been the national government which, in its various phases, and under so many different administrations, always provided all needful means and resources: it is the Argentine people which has accompanied me in my tasks, giving support by their sympathy, and incentive by their kindness.”

The original purpose of the expedition was to make a thorough survey of the southern heavens by observations made in zones between the parallel of 30° and the polar circle; but the plan grew, under the influence of circumstances, until the scrutiny comprised the whole region from the tropic to within ten degrees of the pole,—somewhat more than fifty-seven degrees in width, instead of thirty-seven degrees. And although it was no part of the original design to perform all the numerical computations, and still less to bring the results into the form of a finished catalogue, it has been my exceptional privilege, unique in astronomical history so far as I am aware, to enjoy the means and opportunity for personally supervising all that vast labor, and to see the results published in their definite, permanent form. Of course this has required time. The three years which I had purposed devoting to the less complete work have been drawn out to nearly fifteen; and you will comprehend what that implies for one who loves the friends of his youth, his kindred, and his country. Yet even here there has been consolation. For, while the work has demanded all that period, it did not absorb the whole time, and opportunity was left for other studies. Among the astronomical ones, it has been possible to examine all the stars as bright as the seventh magnitude, up to 10° of north declination, for careful estimates of their respective brilliancy, and to reform the arrangement and boundaries of the southern constellations; also to carry out the observations and computations for another stellar catalogue, more exact than that of the zones, and extending over the whole southern hemisphere. The

total number of different stars in this catalogue is less than in the other; but that of the observations is greater, since each star has been observed many times, as well as with greater precision. This catalogue, too, is at last finished, and in the hands of the printer; and thus it is that I am once more at home with you, my cherished friends.

I am hopeful that the data now collected may throw some additional light upon the great problem of the distribution of the stars in space. Yet, even should these prove insufficient, there is reason to believe that the new labors already begun by my successor, Dr. Thome, who has been connected with the observatory from the very first, will provide whatever additional information may be needful for the purpose. Among the other researches which have gone on while the preparation of the zone catalogue dragged its slow length along, has been a study of the meteorology of the country. The absolute lack of information on the subject had forced itself unpleasantly upon my notice when endeavoring to select the most suitable place for the observatory; and, as it would have been disgraceful for any scientific inquirer to reside in the country without trying to supply the want in some degree, I succeeded in enlisting the aid of various educated men and women in different parts of the country and adjacent ones. The government and congress acceded to my recommendation that a modest sum should be annually appropriated for the purchase of barometers, thermometers, rain-gauges, etc., to be lent to volunteer observers, and for arranging, computing, and publishing the results. In this way was organized, in 1872, the Argentine meteorological office, which has established no less than fifty-two stations, scattered from the Andes to the Atlantic, and from Bolivia to Terra del Fuego. At the end of the year 1884 there were already twenty-three points at which the observations had been continuously made, three times a day, for at least four years, and sixteen others at which they had already been continued for more than two years. These have provided the necessary data for constructing the isothermal lines with tolerable precision for all of South America, from the torrid zone to Cape Horn. Some little has also been accomplished in determining local constants of terrestrial magnetism; and our determinations of geographical position have nearly kept pace with the extension of the telegraph-wires. The beats of the Cordoba clock have been heard, and automatically recorded, amid the plash both of Atlantic and Pacific waves. And the series of longitude determinations made by the U. S. navy expeditions between Buenos Aires and Europe on the one side under Capt. Green, and between the United States and Valparaiso under Capt. Davis on the other, give, when combined with the two South-American measurements, values for the longitude of Cordoba which differ only by one-sixth of a second; this being the total amount of the aggregate errors of the several determinations in a series which, passing through Brazil, the Cape Verde Islands, Madeira, Portugal, England, Ireland, Newfoundland, the United States, Central America, and down the coasts of

Ecuador, Peru, and Chile, completes the full circuit at Cordoba again.

But I will not descant upon collateral matters, nor convert this gathering of friends into an astronomical lecture-room. There are but two points more that I wish to mention. One is, that I cherish a hope that our sojourn at Cordoba may hereafter be considered as marking an epoch in a new method of astronomical observation, namely, the photographic. The inception and introduction of this method belongs to our countryman, Mr. Rutherford; and it was only through his friendly aid in several ways that I was enabled to give it a larger scope, in spite of many obstacles. Now, I can report that every important cluster of stars in the southern hemisphere has been repeatedly photographed at Cordoba, with a precision of definition in the stellar images which permits accurate microscopic measurement; that these measurements are now actively going on; and that the Argentine government has undertaken to provide the means for their continuance under my supervision. It may be that I over-estimate the importance of this new method; but I confess that my expectations are very high. Another year ought to show us whether they are exaggerated or not.

The other point is, that a very large share of the merit which you so liberally attribute to me belongs to the faithful staff of fellow-workers with whose assistance I have been singularly favored. This unselfish devotion to the great undertakings in which they took part, their loyalty, trustworthiness, and ability, have, in the great majority of cases, been beyond all praise. Happily, their faithful and inestimable services to science are placed on durable record; and yet unborn astronomers will know, at least in part, how great have been their deserts. The senior of them, Dr. John M. Thome, whose services began in 1870, before we started southward, is now director of the observatory, where he has begun a new and important work, which will do honor to him and to the institution. Another, Mr. Walter G. Davis, who has labored most earnestly and efficiently for eight years and a half, is now director of the meteorological office, which is assuming large proportions, and under which he is now organizing a meteorological station of the highest class. One noble young man, Mr. Stevens, was summoned, without an instant's warning, to a higher reward than earth could give, leaving no memories behind him other than of affection, admiration, and respect. It was a sore loss for us, and for the bereaved parents in New Hampshire, to whom he was their only earthly stay and staff. Had he lived, his friends and country would have had abundant cause for pride in him. As it is, the number of those who love and honor his memory may perhaps be smaller, but their pride and admiration are no less than had they seen the full harvest instead of the rich promise only. Mr. Bachmann, a native of Austria, who labored with us for more than ten years, is now at the head of the Argentine naval academy in Buenos Aires, with more than three hundred pupils, and an elegant little observatory, where he finds repose from administrative cares in

astronomical work analogous to that to which he gave his energies at Cordoba. He has already undertaken some longitude determinations, and arranged a time-ball, which is probably already giving daily signals, by which the shipping in the outer roads, twelve miles away, may correct and rate their chronometers.

I have spoken longer than I intended, but will make no apologies, for I know your friendly indulgence. It only remains to say for these Argentine scientific institutions, that I believe their success to be now assured; they will enter upon new and enlarged fields of usefulness, as indeed they ought, for the world moves; and, for myself, that the remembrance of this occasion and of your overwhelming kindness will be a source of pride to me through life, and to my children afterwards.

SEMITIC LANGUAGES AT HARVARD.

IN a programme of the Semitic courses given by Professors Toy and Lyon in Harvard university, we find the following statements interesting to the young student. The Semitic family (one of the two inflecting families of the world, the other being the Indo-European) is divided into two groups, in which the several languages are distributed as follows:—

North-Semitic.	{	1. Babylonian-Assyrian.
		{ Classical Aramaic (Syriac). Palmyrene.
	{	2. Aramaic. { Jewish Aramaic. Samaritan. Various modern dialects.
South-Semitic.	{	3. Canaanitic. { Phœnician, older and later (Punic). Hebrew, biblical and post-biblical. Moabite, etc.
		4. Arabic, classical, and modern dialects of the Bedawin, and of Egypt, Algeria, and Syria.
	{	5. Sabeen, embracing several dialects. 6. Ethiopic, and the modern related dialects, Amharic, Tigre, Tigrina.

The two groups differ from each other considerably in grammar and lexicon. A member of either is much nearer to its fellow-members than to any member of the other; thus, Assyrian is more important than Arabic for Hebrew lexicography, and Ethiopic and Arabic are of more value than Hebrew or Aramaic for Sabeen. Still, all these languages have much in common with one another, and each throws light on the others.

The choice of a student will depend on his special aim. Aramaic is the simplest Semitic language in forms, is necessary for the study of the Talmud (Gemara), and contains material for biblical textual criticism, and for the ecclesiastical and secular history of the first sixteen or seventeen centuries of our era. Hebrew is indispensable for the critical study of the Old Testament and Talmud (Mishna). Assyrian is grammatically interesting, and valuable for the early history of western Asia, and for North-Semitic civilization in general. Phœnician exists almost wholly in inscriptions, — a few of which are of historical importance (B.C. 500–A.D. 150), — and in Latin trans-

scription in the *Poenulus* of Plautus. Arabic has most fully preserved the old inflectional forms, is indispensable in the study of general Semitic grammar, and has a large and varied literature, of which the historical part is of great value, and the poetry interesting. Sabeen, or Himyaritic, is found only in inscriptions, which have recently revealed the existence of an ancient and remarkable civilization in southern Arabia, and a language presenting noteworthy peculiarities. Ethiopic, nearly related to Sabeen, is the language of the Christian period of the Semitic colony in eastern Africa. Its literature consists of a Bible translation, monkish chronicles, and versions of several important apocalyptic books. The grammar is remarkable for the symmetry of the verb. At present it has been replaced by various related dialects, one of which was the language of the late King Theodore of Abessinia.

No genetic relation between the Semitic and Indo-European families has yet been discovered. The lexicon of the one does not help that of the other, and only the most general connection exists between their grammars. It is only a seeming exception to this statement, where one language has borrowed from another, as is the case with the modern Persian and the Hindustani, a large part of whose vocabularies is taken from the Arabic, and the Eranian *Huzvares*, which has taken much from Aramaic. Turkish, a member of still another family, is similarly indebted to Arabic.

THE STONE AGE IN AFRICA.

AT the meeting of the Royal society of northern antiquaries, held April 14, 1885, L. Zinck gave an account of the discoveries hitherto made regarding the stone age of Africa. There was now no doubt that Africa had its stone age, as well as Europe. Both in the old cultivated land of Egypt and the well-known desert of Sahara, the inhabitants in their time had only instruments of stone; but he would speak only about the stone age of South Africa. About twenty years since, was made the first find of stone objects in the region of the Cape of Good Hope. We know now that the natives on the south-west coast of Capeland, even at the end of the sixteenth century, paid extravagant prices for iron, and Magaelhens had before found the natives of Madagascar using weapons of iron. Relics of the stone age are also found among the Bushmen, who were driven back to the Kalabari desert, and whose arrow-heads were of stone. There are found in South Africa, from an ethnological point of view, three peoples, — the Kaffirs, Hottentots, and Bushmen, — who represent three waves of migration. The last are the oldest people of the land, and have in their time extended themselves far to the south, where, in the rocky hollows, they have left monuments of various kinds, executed with much ability. They were acquainted with perspective, and had an appreciation of caricature. The Hottentots later drove them back, but were themselves driven back by the Europeans and the Kaffirs. The last, who came from the north, began to encroach on the Cape territory

at the time of its discovery by Europeans. Although it is only twenty years since they began to make collections of the stone age in South Africa, so many specimens have been found, that an older and a younger stone age may be recognized. As yet have been found no objects of polished stone. For a few years past an English railroad-engineer residing at Natal, who had made many finds, has undertaken to examine all South Africa. From his researches, it appears that there are large quantities of stone implements, both in the sea near the Cape, in the alluvial layers at Natal, and in the mountains. It is impossible to fix the time of these stone objects. Kjökken-möddings have also been found in many places, near Simonstown and Capetown, and masses where the Hottentots had burned lime from oyster-shells: these do not belong to the present natives, as the Kaffirs never eat shell-fish, and rarely fish. A find has also been made in the caverns, but nothing is known about it yet. In Basuto-land have been found arrow-heads of flint. From the older iron age the above-named engineer had found, in the layers of gravel near the rivers, and in large hills covered with forest, and in the diamond diggings at Kimberley, implements and chips at a depth of forty feet, where the diamonds occur. It may be concluded that the stone age dates very far back. This shows that the prehistoric ages are not periods of time, but states of development, — in the case of Africa there was a sudden rise from the stone to the iron age, without any intervening bronze period, — the result, not of development from within, but of commercial intercourse from without.

PARADISE FOUND.

THE title of this book will attract attention, and find for it a wide sale. The mode of treatment, and the style too, are such as are most pleasing to the popular mind. The book is very ingenious and learned, but, as it seems to us, conceived and written in the spirit of advocacy rather than in the true scientific spirit. It is true, scientific, as well as every other kind of literature, is laid under contribution; but authorities are used — now a Huxley, and now a Winslow — with little discrimination; and thus conclusions are reached which a cautious science would not accept. Yet we believe the book may be read with profit, even by the scientific anthropologist.

There are few questions connected with man more deeply interesting than the place of his origin; for that he did originate in one place, and not in many places, is now generally admitted. After giving (we think at too great length) the various baseless speculations on this subject, the author states his own thesis;

viz., that the cradle of the human race was a north-polar continent, now submerged; the submergence being coincident with what science calls the glacial epoch, and what universal tradition calls the deluge. This view, he contends, consistently explains and reconciles all traditions and all scientific facts.

He proceeds, first, to remove some obvious objections. The climate of polar regions is now unfavorable for human life, as witnesses the melancholy history of polar expeditions; but in miocene times, as shown by its luxuriant forests of temperate and subtropic species, it was wonderfully mild and equable. During this time, too, one or more large bodies of polar land, or perhaps a polar continent, existed where now only the ocean reigns. Good scientific authorities are cited for this belief.

The long polar night may be thought an objection: but he shows that this has been greatly exaggerated; that there is more day and less night at the pole than anywhere else, viz., six months full day, nearly four months twilight, and only two months full night. Add to this the full moon (which would be above the horizon during the polar night) and the auroras, and the polar man would have no reason to complain.

But the most important scientific contribution to his view is the probable polar origin of many existing species. From miocene times until now, there has been apparently a gradual though not uniform refrigeration of climate; and as a consequence a streaming southward, along all longitudes, of species successively originated by change of climate at the pole. This view, first brought forward by Professor Asa Gray, has been most distinctly formulated by Marquis de Saporta. Among the number thus originating and migrating, the author includes man; and he gives much good scientific authority showing that he is not alone in this belief. But the author, we think, overstates the facts. He seems to think all species originated in polar regions; but this is far from true. It is probably true that there has been from miocene times a streaming southward of species originating there, but undoubtedly many species and genera have been formed by modification in the course of migration. It is not impossible that man, too, if derivative in origin, may have been thus formed in the course of migration. This depends much on the time of his southward migration. If, as the author thinks, this took place in the quaternary, then he probably left his home as *man*, and the modifications have since gone only so far as to form races. This point requires more

Paradise found; the cradle of the human race at the north pole. By WILLIAM F. WARREN. Boston, Houghton, Mifflin, & Co., 1885. 24+505 p., illustr. 8°.

investigation. If the existence of man in miocene time in France and Portugal be confirmed, then our author is wrong. For ourselves, we do not yet accept the miocene man.

All traditions, too, the author thinks, when rightly interpreted, confirm his conclusion. They all point to a golden age and an original home to the north; they all speak of this home as the centre, — the navel of the earth; they all speak of the revolution of the heavenly bodies about a fixed zenithal pole, the abode of the gods; they all speak of a migration enforced by a deluge. To confirm his interpretation, he quotes from traditions of Chaldeans, Persians, Hindoos, Chinese, Japanese, Egyptians, Greeks, and Scandinavians. Classical scholars will doubtless be interested in his view of Homeric cosmology and geography as represented in his frontispiece. To them we leave the question. The author's view certainly seems plausible.

For the author, then, the place of origin was the north pole; the time of origin, the miocene period. The third question is, What was the character of primeval man? On this question the author takes a somewhat middle ground between extreme opinions. He thinks that primeval man of paradise was wholly destitute of all, even the simplest arts, and therefore, we suppose (although he does not say so explicitly), of language. Nevertheless, he thinks he was endowed with simple, and comparatively noble, religious ideas; and that the revolting bestialities of savage life are the result of retrogression. A cautious science will have little to say on this question; but retrogression is certainly as much a law of evolution as is progression. The author's view is therefore not improbable. Childhood, with its simple faith and reverential love, is certainly a nobler thing than a degraded manhood. For obvious reasons we do not think that traditions of a golden age amount to much as argument.

But when the author sustains the traditional idea of gigantic stature and millennial longevity of primeval man, science will, we think, demur. The popular belief that animals of early times, in comparison with existing species, were gigantic, will hardly bear examination. The true view seems to be this: in the history of the earth, there have been periods peculiarly favorable for the development of different orders and families of animals, during which they increased, culminated, and then declined. The mesozoic was such a period for reptiles, the tertiary for mammals. The time of culmination, however, is never at the beginning, but in the middle or near the end. Is it not

possible that the present is such a period for man? All the scientific evidence we have is in favor of increasing rather than decreasing size. Also we would remind the author that the decreasing size of which he speaks was in successive species, and even genera. Will he admit that the Edenic man was a different species, or even genus? He may, indeed, well do so, if he carries man back to the miocene. Again: if he likes analogies of this kind, we would remind him of the very notable increase of brain-size in all families of animals since miocene times. Is he prepared to admit the very small brains of Edenic man?

The millennial longevity we dismiss with the remark that we do not believe it can be sustained on natural grounds.

We are sure the author will thank us for calling his attention to some scientific mistakes. 1. On p. 66, in speaking of polar twilight, he says in substance, that, if twilight continues until the sun is 20° below the horizon, it would make a full polar night of sixty days; but, if until 24° (which he thinks probable), it would make it only fifty days. Now, the inclination of the ecliptic is only $23^\circ 28'$: therefore the sun would never get so far below the horizon, and therefore in the case supposed there would be no night at all. 2. On p. 194, speaking of the aspect of the heavens on Pamir plateau, he says that the pole of the heavens is tilted about one-third from its zenithal position towards the horizon. It is nearer two-thirds, for its latitude is about 35° . 3. On p. 412, as an example of degradation instead of progression, the author quotes from *Science* to the effect that the recently discovered Silurian scorpion is a more perfect specimen than any found in later formations; but the writer obviously meant more perfectly preserved specimen, not more perfectly organized animal.

THE LENÂPÉ AND THEIR LEGENDS.

THE *Walam o'um* (or 'picture record') of the Delawares has long been known to scholars, though imperfectly, as one of the most remarkable productions of the Indian intellect. It was discovered about the year 1820, somewhere in the west (exactly how or where is uncertain), by that eccentric naturalist and antiquarian, C. S. Rafinesque, who held for some years the very comprehensive professorship of the 'historical and natural sciences' in Tran-

The Lenâpé and their legends; with the complete text and symbols of the Walam o'um. By DANIEL G. BRINTON, A.M., M.D. Philadelphia, Brinton, 1885. (Brinton's library of aboriginal American literature, No. 5.) 67+262 p., illustr. 8°.

sylvania university, Kentucky. After his death in 1840, the manuscript of the Delaware record came for a time into the hands of the distinguished archeologist, Mr. J. L. Squier, who in 1848 read before the New-York historical society an incomplete summary of its contents, giving only a portion of its Indian text and of the symbols. This was published soon after, in the *American review*, and has been since reprinted in other publications. Thus enough has been known of this singular composition to excite the curiosity of students of Indian archeology, who have long regretted the disappearance and supposed loss of the original manuscript. By persistent inquiry, Dr. Brinton has succeeded in recovering it, and has now published the work in full, with all the mnemonic signs, the Delaware text, a new and exact translation, an ample introduction, and many useful notes.

Rafinesque's peculiarities, and some other circumstances have caused a doubt to be cast on the authenticity of the *Walam olum*. The evidence adduced by Dr. Brinton, however, seems quite sufficient to show that it is a genuine Indian production, though its date and authorship are uncertain. Any one who will compare the symbols, or picture-signs, in this work, with those given by the native historian, Copway, in his 'Traditional history of the Ojibway nation,' will be satisfied that they belong to the same system of notation. In fact, of the fifty symbols depicted in Copway's book, about half appear in the *Walam olum*, either precisely the same, or with just such variations as might be expected in an independent work. These symbols are, in part, rude representations of natural objects, — sun, moon, and stars, man, snake, fish, river, canoe, and the like, — bearing, as might be expected, a certain resemblance to the curt pictorial outlines from which the Chinese characters were developed. Besides these, there are some purely conventional symbols, which are found both in Copway's book and in the present work, and which show that Indian inventiveness had already passed into the higher stage, in which ideas as well as objects are represented. A hollow square or parallelogram signifies 'great.' A circle with a point in the centre is the sign for 'spirit,' and, when made of unusual size, indicates 'the great spirit.' Four angular points jutting from it in opposite directions represent the cardinal points, and convey the meaning of 'the great spirit everywhere.' Thus the Lenâpé and the Ojibways were on the very verge of that Egyptian method of word-pictures which preceded the invention of the alphabet.

Each symbol of the *Walam olum* recalled to the mind of the record-keeper the verse or strophe of a chant. Thus, when he drew forth from his bundle of 'painted sticks' the one on which this symbol of the great spirit was depicted, he recognized it as indicating a well-known verse of five Lenâpé words, which are here given opposite the symbol, and which Dr. Brinton's version renders, "At first, forever, lost in space, everywhere the great Manito was." In about two hundred such strophes, indicated by as many symbols, we have the Lenâpé cosmogony set forth, followed by a history of the early wanderings of their people, and a list of ninety chiefs who successively held the headship of the tribe. Many interesting questions are raised by this history, which Dr. Brinton has not undertaken to answer; but he has supplied abundant materials and aids for students who desire, as doubtless many will, to pursue this attractive investigation.

His introductory chapters furnish a succinct account of the tribes of the Algonkin stock, and of their neighbors the Iroquois, whose history is closely connected with their own. The political constitution of the Lenâpé septs, their mode of life, their religious belief and ceremonies, their moral and mental character, are concisely but clearly delineated. Their language is carefully analyzed; and the existing sources, in print and manuscript, from which a knowledge of it may be obtained, are more fully recorded than has ever before been done. Certain disputed points in the later history of the nation are well discussed, though in some of these the author must expect to encounter opposing views. Throughout this introduction, and indeed in the whole work, the marks of great labor and of conscientious care are apparent. Evidence also is seen of the insight derived from long-continued study of the Indian character, customs, and languages. The volume will not merely be in itself a most valuable acquisition to all students of American archeology, but might well serve as a model for future inquirers who may have occasion to undertake similar researches.

KINGSLEY'S MADAM HOW AND LADY WHY.

WE once heard an eminent actor describe Charlotte Cushman as "a magnificent example of a style of acting now happily passed by."

Madam How and Lady Why, or first lessons in earth-love for children. By CHARLES KINGSLEY. New York, Macmillan & Co., 1885. 18°.

Some similar phrase would be the best formula for Charles Kingsley's book, now reprinted as one of Macmillan's 'Globe readings from standard authors.' The style it represents is not, to be sure, the old plain-dealing manner of Mrs. Marcet and her 'Conversations about common things,' where John and William demurely put hard questions, and Mr. A. or Mr. B. sedately answers; but it is the modern, rollicking, galvanized form of the same thing, where the preceptor calls himself 'Daddy,' where the pupil is addressed as 'My dear child' on almost every page, and 'My pretty boy' occasionally, where the plain facts about rocks or fishes must be garnished with all manner of metaphor and rhetoric, and where every chapter must wind up with a high-flown rhythmical passage composed of Ruskin-made-easy. To those who like that sort of book, it may be said, borrowing the words of President Lincoln, that 'this is just the sort of book they will like.' But we confess ourselves not to be of that opinion.

Unless we greatly mistake, the taste, even of children, has now changed for the better. It is not now thought necessary to write down to them; to pet them, so to speak, in printer's ink; to remind them in every other sentence of the fact they know best, namely, that they are not grown up. It has been discovered that what they need is merely the straightforward simplicity of language which even grown people like best. It is not necessary to take every common fact and turn it vivaciously into a metaphor; to personify two new intermediate agencies in the universe under the names of 'Madam How' and 'Lady Why,' and then to provide them with two grandsons, 'Analysis' and 'Synthesis' (p. 158); all these personifications being, after all, so ineffectual that the author has to bring in at last a higher creative power (p. 10), called the 'Master,' whom they all obey, and the reference to whom makes this labored mythology very superfluous. This is the head and front of our objection to the book,—that it is not truly scientific, because it is not simple. It tends to impair, not to foster, the spontaneous love that children have for the fascinating truths of out-door nature: it is an attempt to make sandwiches with sugar-plums, and to flavor bread and cheese with vanilla.

This fundamental defect pointed out, it must undoubtedly be admitted that this little book contains a great deal of valuable and interesting knowledge conveyed often in an exceedingly graphic way. Even here, however, there are two drawbacks. One lies in the character of

Canon Kingsley's mind, which was dashing, impetuous, and always ready for too sweeping conclusions. To say, for instance, almost at the beginning, "I never saw a valley however deep, or a cliff however high, which had not been scooped out by water" (p. 25); and to reiterate again and again that 'water, and nothing else,' has done all these things, without a word of reference to volcanic action, or upheaval, or subsidence, or lateral pressure,—is certainly a very loose and unguarded way of writing. Again: there is the minor objection that the book, being prepared specifically for English children, is very properly full of local references and illustrations that will mislead and perplex young Americans, just as the older men among us used to be perplexed in childhood by trying to identify the birds and plants around us with the very different species described in the English manuals. Many of the author's most important illustrations of the formation of mountains and valleys, for instance, are drawn from the features of those miniature cañons on the English coast—in the Isle of Wight, for instance—known as 'chines' (pp. 18–22). But what American child knows, or how many American teachers, indeed, know, what a 'chine' is? The word does not even appear in Worcester's 'Dictionary,' except as meaning a piece of an animal, or part of a vessel.

A MONOGRAPH OF BRITISH FOSSIL BRACHIOPODA.

With the present appendix (vol. v. part iii.) a monumental work has been brought to a close. The labors of Thomas Davidson, F.R.S., need no introduction to paleontologists of any part of the world. The quiet distribution of the concluding fasciculi of the 'British fossil Brachiopoda' should not be allowed to pass without notice.

Thirty years have passed since the publication of the general introduction to the first volume of this monograph. Coincidentally with, and largely induced by, its progress, a vast amount of precise knowledge has been acquired and made public, in regard to all that relates to the history and distribution of the brachiopods. Indeed, our knowledge of them, in any sufficient sense, may be almost said to date from about the time when the learned author began his labors; and the earliest known reference to them in any printed work dates only from 1606. The present appendix closes a series of researches, begun just half a century ago,

on the brachiopods of the British islands. During that period, Mr. Davidson has not only prepared the text of his monograph, and numerous collateral and frequently very important papers on the general subject, but has drawn with his own hand more than two thousand admirable and artistic plates by which that text has been illustrated and adorned. Seldom has fortune equipped more completely a student for his life-work than in the present case, when more than ordinary artistic talent, a liberal education, independent means, were joined to unsurpassed devotion in the pursuit of knowledge, and impartiality in the recognition of the labors of others in the same field.

The steady stream of information induced by the publication of successive parts of the monograph has necessitated supplement after supplement. The present and concluding part not only contains such material, but a catalogue of, and index to, the British genera and species, bibliographical and stratigraphical, and, more important than either for the general biologist, a summary of progress in our knowledge of the class up to the present time. This includes notices, under separate heads, of the test, the embryology, the affinities, the adult anatomy, habitat, and ranges in depth, of recent species, characters of the fossil genera, and classification discussed by families. Full space is allotted to the advocates of contending theories: Kovalévski's valuable paper on the embryology is given in full abstract, with excellent figures; various suggested pedigrees are quoted; the brilliant rise, and slow but continuous decadence, of the 'worm theory,' is related, with generous recognition of the sagacity of Morse in the detection of affinities to which the then imperfect knowledge of the molluscan pedigree, and his remarkable researches into the early stages of Terebratulina and Lingula, lent a plausible, but, as it has since proved, a one-sided interpretation. The general conclusion is reached, that, however great the probability of continuous descent, with modification, as an explanation of the various forms of brachiopods now or previously existing, the paleontological record presents many facts inexplicable by, or even opposed to, this theory; while of natural selection there seems to be absolutely no visible trace. The number of British forms which, at the commencement of the work, numbered 13 genera, and 454 partly invalid species, has now expanded to 74 genera, and 976 species and varieties, to which even now accessions continue to be made.

In taking leave of his task, so worthily performed and to be continued by younger hands,

the author, in spite of certain infirmities, does not relinquish his studies, but is now engaged on a monograph of the recent species, which it is to be hoped he may be spared to complete to his own satisfaction and the undoubted benefit of science.

W. H. DALL.

NOTES AND NEWS.

—THE prize of 500 francs, founded by Augustin-Pyramus de Candolle, has been awarded to Professor Planchon, professor of botany at Montpellier, for his memoir on the Ampelidees.

—A geographical society has been established at Rio de Janeiro, under the presidency of Viscount de Paranaguá, with Baron Teffé and Señor Henriques, vice-presidents; Carlos Montéro and Pereira Coruja, secretaries.

—According to the *Oesterreichische monatschrift für den orient*, the preference shown in England and her colonies for Indian teas is causing considerable anxiety among the native and European tea-establishments of China. Calcutta alone sent to England, in the past year, 62,773,187 pounds, against 58,830,478 in 1883, and 51,579,740 in 1882; while the Australian and New Zealand markets received, in 1884, 1,029,463 pounds, against 696,479 in 1883. To be sure, this figure shows a great falling-off from 1882; yet at present a preference is manifested in Australia for Indian teas, which, like those of Ceylon, whose production probably has a similar future, far surpass in quality the average teas of China. Also the success of Natal, in the production of tea, warrants the assumption that South Africa will soon enter the market. The total export of Foochow, the greatest tea-depot of China, amounted, in the last season, to 77,631,997 pounds, against 81,100,875 for the same time last year. In Hankow, Canton, Shanghai, and Macao the same proportion is seen. The falling-off in the export of all China against the past year amounts to about ten million pounds, and may be ascribed to the reduction in quality of the Chinese teas. How far this decrease may have been due to the French operations cannot be told.

—Another party for the scientific exploration of Greenland is being organized by the authorities at Copenhagen. It will be commanded by the naval lieutenant, J. A. D. Jensen, assisted by Lieut. C. H. Ryden.

—In a recent visit to Russian Lapland, Rabot visited the valleys of Pasvig and Talom and Lake Enara. The entire country is an immense forest, dotted with lakes and pools, and cut by rapid streams. The latter, though very difficult of navigation, form the sole roads of the country. The Pasvig, for instance, in its course, forms more than thirty cascades and rapids. Lake Enara, from which it flows, is an interior sea, dotted with thousands of islets covered with magnificent pines. The climate is very rigorous; the short summer is, however, quite hot, but in August frosts are not unknown. The country around Lake

Enara is level, and forms a depression between the plateau of Finmark and the highlands of Russian Lapland. This, in a political point of view, is important; since it permits of comparatively easy communication between Finland and the coast of the Northern Ocean. There are excellent ports on this shore never obstructed by ice, but hitherto useless for want of communications with the interior. In the near future, the railway, which has already reached Uleaborg, will be completed to the northern coast, and Russia will be able to utilize a part of her possessions, at present little better than a wilderness.

— Van Braam Morris, Dutch resident at Ternate, has recently made some interesting discoveries on the northern coast of New Guinea, which he visited officially for the purpose of familiarizing the natives with the Dutch flag, and arranging a peace between several contending tribes. After determining the longitude of Mapia, it was found that Stephen Island of the charts has no existence. The coast near Walckenaer Bay was visited; and several rivers of considerable size, as well as a large lagoon, were found, which were before unknown. The population, calling themselves Bongos, were numerous and friendly, living in houses built on piles in the water. Coconuts were so abundant that two hundred and fifty could be purchased for twelve cents; and large quantities of kopra are made. Subsequently the Amberno River was visited, and ascended sixty miles or more with a depth of six fathoms, with a fathom less in the channel over the bar. In latitude $2^{\circ} 20'$ south, the river emerges from the mountains; and here were shoals beyond which the party did not go. The current was extremely rapid. The male inhabitants of its banks were timid but friendly: the women always took refuge in the forest. They call the stream 'Mamberan' (or great river). It has never been ascended by civilized man; and it is claimed that the results of Van Braam Morris's explorations are more important to geography than any work done in this region during the century, and only second in New Guinea to the work of Albertis.

— Messrs. Charles Scribner's sons published, May 1, the book of Stepniak, the nihilist writer, author of 'Underground Russia,' entitled 'Russia under the tzars.' The timeliness of its publication is a matter of accident, as the author and translator have been for some time superintending its passage through the press in London; but it is particularly welcome at a moment when universal attention is fixed upon its subject.

— Within a week of the publication of Messrs. Scribner's authorized edition of 'The Russians at the gates of Herat,' they were obliged to print nine thousand copies to supply the demand, and another edition of three thousand has just been put on the press.

— Reports from Japan state, says *Nature*, that grave fears were entertained of an outbreak of the long quiescent volcano Fujiyama, and that officials had been sent to investigate the matter. The people living in the neighborhood believed an eruption to be imminent, because, while the snow on the mountain

had begun to melt two months before the usual time, all the wells at the fort became dry, and difficulty was experienced in procuring water. The phenomenon is considered the more remarkable from the fact that the winter has been unusually cold, and that the surface of the snow remains hard, the part nearest the ground being the first to give way.

— The council of the New-England meteorological society has deemed it advisable to select a new subject for special study during the summer season of 1885, and has chosen thunder-storms as offering at once the greatest number of features easily observed, and promising in return the most interesting results. The desired observations will be divided into several classes, in order to bring the work within the reach of all who are willing to take a share in it. Observations are to be taken through the summer whenever a thunder-storm can be seen or heard. Besides these, special observations of wind, temperature, etc., are desired on the Saturdays of June (June 6, 13, 20, 27), at intervals from noon to nine o'clock P.M., whether a thunder-storm is in progress or not. Saturdays are chosen with special reference to securing assistance from the scholars in our many schools. Instructions, and blanks for records, will be sent on application to W. M. Davis, Cambridge, Mass.

— Vol. i. of the Transactions of the scientific association of Meriden, Conn., which has just been printed by the association, appears as a tribute to the memory of a deceased member, Miss Emily J. Leonard, whose catalogue of Meriden plants, left incomplete at her death, occupies the principal part of the pamphlet. Although the plant names have in a few cases served as stumbling-blocks in the way of the editors, the list, which includes 749 phenogams and pteridophytes, is very creditably presented.

— *Nature* reports that the National fish-culture association of England has transferred another large consignment of white-fish fry to the lakes in the Isle of Mull in order to further their acclimatization to the waters of this country. Hitherto many experiments have been tried in this direction, but with no success. The American government is rendering valuable assistance in effecting their propagation, and are watching the result of the endeavors now making with keen interest.

— The French government has granted the use of the Palace of Industry, in the Champs Elysées, for the purpose of holding the Great industrial exhibition (*Exposition du travail*), which will remain open from the 23d of July until the 23d of November, 1885.

— The collections and library of the New-Orleans academy of sciences have been removed to rooms furnished by the Tulane university. It is hoped that some additional vigor may be imparted to the academy by the presence of the scientific men visiting the exhibition. E. T. Merrick, ex-chief-justice of Louisiana, is president.

— Systematic observations of auroras have been made at the Engineer station, Willet's Point, N.Y., under the direction of Gen. H. L. Abbot since 1870.

The uniformity and continuity of the system of observations make the results of much interest. Three sentinels are on duty during the night, and each is required to report, when relieved, whether he has seen any auroral light during the night, and, if not, whether the sky has been sufficiently clear to permit any to be visible. At the end of the year the number of auroras, taking the mean result from the three observers, are added, and also the number of nights on which auroras could not have been seen owing to clouds. The probable number for the year is obtained by increasing the observed number in the same ratio as that of the cloudy nights to the clear nights. The results are shown in the following table. The last column of the table gives the average number of sun-spots as observed by Prof. D. P. Todd.

Summary of auroral records for fifteen years.

Year.	Clear sky.		Cloudy sky.		Total for year.	Average no. of sun-spots.
	Nights.	Observed auroras.	Nights.	Probable auroras.		
1870 . .	184	50	150	41	99	-
1871 . .	211	60	154	44	104	-
1872 . .	234	60	132	34	94	-
1873 . .	214	54	151	38	92	-
1874 . .	190	18	175	17	35	-
1875 . .	189	14	176	13	27	-
1876 . .	195	9	171	8	17	-
1877 . .	191	7	174	6	13	2.6
1878 . .	185	2	180	2	4	2.2
1879 . .	204	9	161	7	16	2.0
1880 . .	216	13	150	9	22	14.3
1881 . .	191	23	174	21	44	26.7
1882 . .	201	55	164	44	99	28.3
1883 . .	215	24	150	17	41	27.4
1884 . .	180	12	186	12	24	38.0

— According to the explorer, Col. Prjevalski, Thibet appears to be a paradise for gold-diggers. In the letter in which he describes the discovery of the sources of the Yellow River (the Hoang-ho), he writes: In the neighborhood of the southern slope of the Burchan-Budda, we met with about thirty friendly Taughts, who were employed in gold-washing. The whole of northern Thibet seems very rich in gold. At the gold-washing place we visited, the Taughts were digging the gravel containing the gold from a depth of only from about one to two feet; and, though the gold-washing was only done in the most primitive way, the Taughts showed us whole handfuls of gold in large pieces, of which none were smaller than a pea. Doubtless, careful working of the gold-washing process would yield enormous treasures. It seems to me, too, that the prophecy is not too bold, that Thibet, in time, will prove a second California.

— Dr. Aurel Schulze, the son of a German colonist in Natal, has recently returned from a successful journey into the interior. He advanced up the Kuando, or Chobe, for a considerable distance, and proceeded thence to the Kubango, where his farther progress to the west coast was stopped through the hostile attitude of the natives. He returned to Natal by way of lake Ngami and the Transvaal.

— A. Riche has presented a report to the Council of hygiene of the department of the Seine, in which he states that vaseline should not be used for alimentary purposes, as it is injurious to health. This substance has been recommended for use in pastry, as it is said to show no tendency to become rancid.

— The Académie des sciences offers for this and the three following years a medal of the value of three thousand francs, for some important improvement in the theory of the electric transmission of work. The Bordin prize of three thousand francs is also to be given for the best memoir on the origin of atmospheric electricity, and the causes of the great development of electrical phenomena in storm-clouds; this to be sent in before the 1st of June next, the other before the 1st of June, 1886.

— Tea-cultivation is making some progress in Italy. In the province of Novara a plantation is reported to be doing well; and at the agricultural show at Messina, in 1882, Signor d'Amico exhibited a hundred plants three years old, that had been grown in the province of Messina. The Italian government has sent to Japan for a supply of plants.

— The prize offered by the Société d'encouragement pour l'industrie nationale, of forty pounds, for the discovery of 'a new alloy useful in the arts,' has been awarded to P. Manhés, on account of his discovery of the value of an alloy of copper and manganese for improving the quality of commercial copper. Manhés prepares an alloy of seventy-five per cent copper, and twenty-five per cent manganese, and adds it in small quantities to the molten copper after refining and just before casting, stirring the bath of metal at the same time. The manganese of the alloy is stated to immediately combine with the oxygen of the dissolved cuprous oxide, forming a manganiferous slag which is easily removed. The operation is cheap, and very much improves the quality of the copper so treated. Also several of the principal alloys of copper, bronze, gun-metal, brass, are of superior quality when prepared with copper purified in this manner; and copper so treated is more slowly acted upon by sea-water.

— Obrecht published, in a recent number of the *Comptes rendus*, his result for the solar parallax as derived from measures of the photographs of the transit of Venus of 1874, obtained by the astronomers of the French expeditions. The value found is 8.80", but it is not final, having still to be corrected for some elements in the calculation whose precise value is as yet unknown. A few years ago, Professor Todd, in a similar way, obtained a preliminary result from the American photographs of the same transit, which was 8.88" for the solar parallax.

— 'The sun,' by Rev. Thomas W. Webb (New York, *Industrial publication company*, 1885), is 'a familiar description of the sun's phenomena.' It is after the style of the scientific primers, and gives in seventy-seven small pages of coarse type a clear idea of how the distance of the earth from the sun is determined, and of what is going on upon the sun's surface.